

EE/CPRE/SE 491 WEEKLY REPORT 04

INTRODUCTION

Date: March 1 - March 8

Group Number: 21

Project Title: Battery-less IoT Devices

Advisor: Dr. Henry Duwe

Clients: Dr. Nathan Neihart, Dr. Daji Qiao

Team Members:

Derek Nash – *Meeting Scribe, Power Systems Engineer, Test Engineer*

Matt Goetzman – *RF Systems Engineer, Test Engineer*

Mohamed Gesalla - *RF Systems Engineer, Test Engineer*

Adithya Basnayake – *Report Manager, Power Systems Engineer, Test Engineer*

Mohammed-Al-Mukhaini – *Meeting Facilitator, Embedded Systems Engineer, Test Engineer*

Bradley Rhein – *Embedded Systems Engineer, Test Engineer*

WEEKLY SUMMARY

During this week, we focused on getting parts to start building the rectifier circuit and improving the antenna design. We postponed our weekly advisor meeting to next week so that we have a physical prototype of the rectifier circuit and a more efficient antenna model.

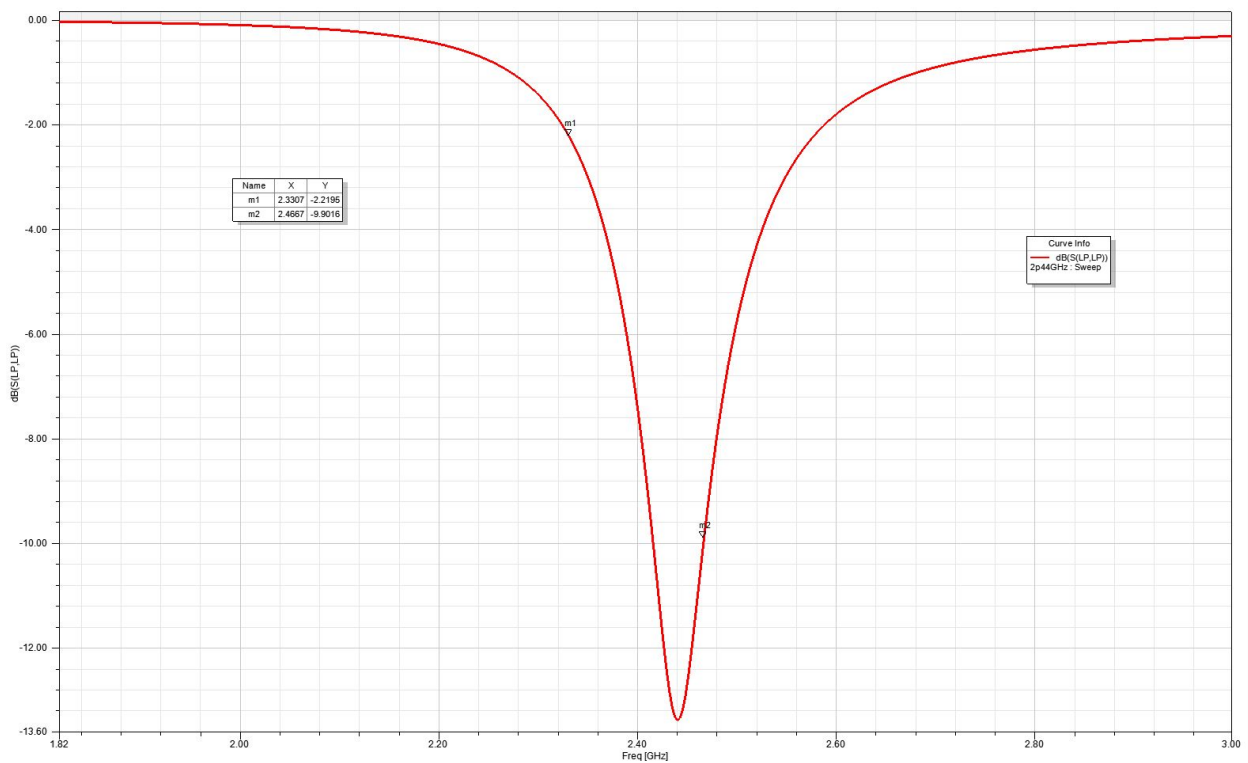
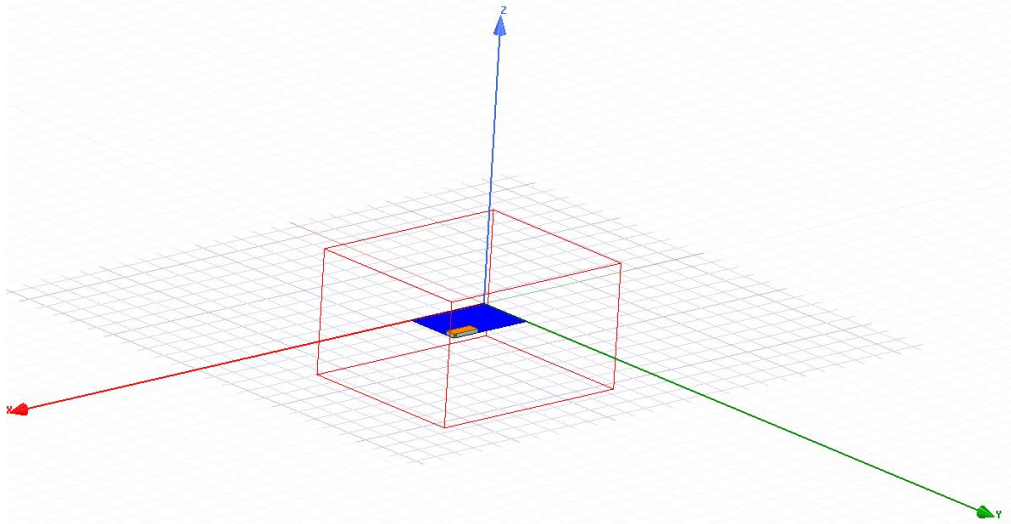
PAST WEEK ACCOMPLISHMENTS

Embedded Systems Team

RF and Antenna Team

This week we attempted to design a PIFA (Planar Inverted-F Antenna) due to professor recommendation. We based our design off of a previous EE417 lab manual for creating PIFA antennas by Dr. Jiming Song. By creating a PIFA antenna with Ansys HFSS we can have control over our design parameters which can allow us to design much more precise antennas as well as simulate them. We are attempting to create an antenna that fits onto the main board made of FR4 epoxy. FR4 Epoxy is a common PCB board but it's also

not made for antenna design so there will be some issues with how the antenna performs. So far the gain is 0dB (which isn't terrible) but it could be better. The gain doesn't reduce by much at the edge of 2.4GHz, and the beamwidth is roughly 40-50 degrees across at the main beam. The advantage of this design is that it can fit on the board and takes up very little space. We've learned that the substrate and thickness of the board contribute greatly to the gain of the antenna. It seems that thicker substrates raise the gain of the antenna as well as contribute to an impedance effect that needs to be tuned away. Next week we plan on refining the design and possibly looking in to antenna arrays with this or other designs.



Power Circuit Team

The Schottky diodes we had previously planned to order turned out to be too small for humans to solder. The team checked resistor sizes with the ETG and learned that components labeled "0603" (Imperial units: 6/100 of an inch by 3/100 of an inch) is about the smallest we can manageably solder. We ordered another set of Schottky diodes from DigiKey. We made sure to check these diodes are of a manageable size and they have a very low voltage drop. We also agreed to use the software Advanced Design System to model the circuit, so we could get its impedance and read the DC voltages at different stages of the voltage multiplier.

Following shows the Schottky diode that we ordered.



Researched on Greinacher voltage doubler circuit to find the component values needed to maximize the voltage output.

PENDING ISSUES

The power circuit team needs to learn EaglePCB (to design the rectifier PCB) and Advanced Design Systems (to simulate the circuit and test for feasibility).

RF Team wants to know what kind of options we have for board sizes/substrates for electromagnetic properties.

INDIVIDUAL CONTRIBUTIONS

Team Member	Contribution	Weekly Hours
Derek Nash	Researched acceptable diodes for soldering, met with Dr. Neihart to discuss methods for simulating a circuit, and studied voltage multipliers. Planned antenna interface with Matt. Wrote the weekly status report.	3
Matt Goetzman	Worked on designing PIFA antenna for a 1.65mm FR4 board	2
Mohamed Gesalla	Worked on designing and troubleshooting a PIFA antenna	2

Adithya Basnayake	Researched on diodes to order for the rectifier circuit. Researched on Greinacher voltage doubler circuit and component values to be used to get the maximum voltage. Wrote the weekly status report.	3
Mohammed-Al-Mukhaini		
Bradley Rhein		

PLANS FOR THE UPCOMING WEEK

The Power Circuit team plans to learn Advanced Design Systems in preparation for simulating the rectifier and testing its impedance and output voltages.

RF Team will try to refine design of PIFA antenna for use on board as well as get help determining best possible substrate for overall design.

SUMMARY OF WEEKLY ADVISOR MEETING

No advisor meeting this week.